

A. COVER SHEET

Proposal Title: Sacramento River Winter Chinook Salmon Carcass Survey
Applicant Name: Fish and Wildlife Service, Northern Central Valley Fish and Wildlife Office

Primary Contact: James G. Smith
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Amount of funding requested \$93,765 (Year 1), \$103,449 (Year 2), \$108,059 (Year 3)

State cost: \$ _____ Federal cost: \$ _____

Cost share partners? Yes No XXX (Identify partners and amount contributed by each)

Indicate the Topic for which you are applying (check only one box).

Natural Flow Regimes	Beyond the Riparian Corridor
Nonnative Invasive Species	Local Watershed Stewardship
Channel Dynamics/Sediment Transport	Environmental Education
Flood Management	Special Status Species Surveys & Studies
Shallow Water Tidal/ Marsh Habitat	<input checked="" type="checkbox"/> Fishery Monitoring, Assessment & Research
Contaminants	Fish Screens

What county or counties is the project located in? Shasta County

What CALFED ecozone is the project located in? 3.1 Sacramento River

Indicate the type of applicant (check only one box):

State agency	<input checked="" type="checkbox"/> Federal agency
Public/Non-profit joint venture	Non-profit
Local government/district	Tribes
University	Private party
Other:	

Indicate the primary species which the proposal addresses (check all that apply):

San Joaquin and East-side Delta tributaries fall-run chinook salmon	
<input checked="" type="checkbox"/> Winter-run chinook salmon	Spring-run chinook salmon
Late-fall run chinook salmon	Fall-run chinook salmon
Delta smelt	Longfin smelt
Splittail	Steelhead trout
Green sturgeon	Striped bass
White Sturgeon	All chinook species
Waterfowl and shorebirds	All anadromous salmonids
Migratory birds	American shad
Other listed T/E species:	

Indicate the type of project (check only one box):

☒ **Research/Monitoring**

Pilot/Demo Project

Full-scale Implementation

Watershed Planning

Education

Is this a next-phase of an ongoing project? Yes XXX No —

Have you received funding from CALFED before? & No XXXX

If yes, list project title and CALFED number:

Have you received funding from CVPIA before? Yes XXX No —

If yes, list CVPIA program providing funding, project title and CVPIA number (if applicable): **m**

The U.S. Fish and Wildlife Service has previously received funding for this project through an AFRP proposal entitled *Expanded winter-run chinook salmon carcass survey: Upper mainstem Sacramento River*. The Department of Fish and Game has also received previous funding for this project **through** AFRP and CVPIA. The title of CDFG's AFRP proposal is: *Winter-run chinook salmon escapement survey, Sacramento River*. Additional funding for CDFG was secured through CVPIA/AFRP as part of the AFRP project entitled: *Continue to conduct instreamflow studies on the Sacramento, American, and Merced rivers*.

By signing below, the applicant declares the following:

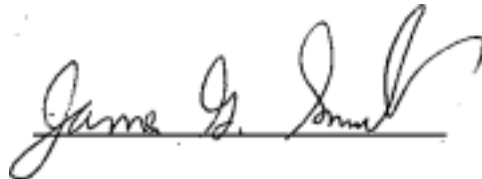
The truthfulness of all representations in their proposal,

The individual signing the form is entitled to submit the application on behalf of the applicant (if the applicant is an entity or organization); and

The person submitting the application has read and understood the conflict of interest and confidentiality discussion in the PSP (Section 2.4) and waives any and all rights to privacy and confidentiality of the proposal on behalf of the applicant, to the extent as provided in the Section.

Printed name of applicant: James G. Smith

Signature of applicant:



B. EXECUTIVE SUMMARY.

Proposal Title: Sacramento River Winter Chinook Salmon Carcass Survey

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Northern Central Valley Fish and Wildlife Office

Primary Contact: James G. Smith
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Amount of funding requested: \$93,765 (Year 1), \$103,449 (Year 2), \$108,059 (Year 3)

Participants and collaborators: California Department of Fish and Game
Environmental Services Division
Stream Flow & Habitat Evaluation Program
Sacramento, CA

1. Project Description And Primary Objectives:

The Sacramento River winter chinook salmon carcass survey takes place in Shasta County, from Keswick Dam at river mile (RM) 301 downstream to powerline below Clear Creek Riffle (RM 292). This area, included in CALFED Ecozone 3.1 (Sacramento River, Keswick Dam to Red Bluff Diversion Dam), contains the majority of available spawning habitat for state and federally listed endangered winter chinook salmon.

The U.S. Fish and Wildlife Service's Northern Central Valley Fish and Wildlife Office and California Department of Fish Game's Stream Flow and Habitat Evaluation Program will continue to jointly conduct a spawning ground carcass survey to estimate escapement of winter-run chinook salmon. **This** project as proposed is a monitoring program designed to estimate the abundance of adult, endangered winter-run chinook salmon with greater accuracy than estimates generated through the Red Bluff Diversion Dam fish ladder counts. Other objectives will be: to collect baseline information on several important life history attributes of winter chinook salmon (i.e. age, sex ratio, temporal and spatial spawning distribution, and pre-spawning mortality); to evaluate the effectiveness of ~~the~~ winter chinook salmon propagation program to assist in species recovery; and, to collect tissue for genetic analysis to characterize winter-run chinook salmon population (for run discrimination work and to maintain genetic diversity in hatchery and natural stocks).

Of primary importance, the monitoring program tests the hypothesis that current and future implementation of AFRP, CVPIA, CALFED or other restoration program action and activities are resulting in a measurable and scientifically defensible increase in abundance of this endangered species. This monitoring action is therefore in direct support of CALFED ERP Goal 1 (Recovery of At-Risk species) as presented in the PSP.

C. PROJECT DESCRIPTION.

1. Statement of the Problem

a. Problem

Accurate estimation of the number of endangered winter-run chinook salmon that return to the upper Sacramento River is critical to provide a direct measure of the success of AFW and other management activities intended to directly increase population numbers of salmon and steelhead. Estimation of winter-run chinook salmon run-size using Red Bluff Diversion Dam (RBDD) counts through the ladders accounts for the final 15% of the run Winter-run chinook salmon. Mainstem carcass surveys, however, executed during May through August have distinct advantages over the Red Bluff Diversion Dam (RBDD) estimation method, in that the entire spawning period is encompassed. The collection of information to allow more accurate estimations of population size and structure, will provide the basis for identifying future management actions necessary to accomplish AFRP goals and listed species recovery and delisting.

Primary objectives of the winter chinook salmon mainstem carcass surveys are three fold: 1) to estimate escapement of winter chinook salmon; 2) to evaluate the potential for hatchery supplementation to assist in species recovery; and, 3) to collect tissue samples for genetic analysis to characterize winter-run chinook salmon population (for run discrimination work and to maintain genetic diversity in hatchery and natural stocks). In addition to collecting data on spawner abundance, information is also collected during the field surveys regarding several important life history attributes of winter chinook salmon including age and sex composition, pre-spawning mortality, and temporal and spatial distribution of spawning.

Winter chinook salmon spawn exclusively in the upper Sacramento River the upper reaches of tributaries to the upper Sacramento River. Since 1971, escapement estimates for winter chinook salmon have been based upon counts of salmon passing through fish ladders at Red Bluff Diversion Dam (RBDD; river mile 243). Between 1971 and 1986, RBDD was typically operated throughout the entire period of winter chinook salmon migration in the upper Sacramento River (December - July) allowing for complete accounting of escapement. Beginning in 1987, operation of RBDD was restricted to facilitate improved passage of winter chinook salmon which were at critically low and declining population levels and had been previously petitioned for listing (October 1985) under state and federal Endangered Species Act (ESA). Since 1995, the RBDD has been operated from approximately 15 May through 15 September.

Current winter chinook salmon population estimates based on RBDD fish counts are calculated by expanding weekly fish passage estimates based on the average proportion of passage recorded during historic, season-long counts. Based upon complete season counts made prior to 1987, an average of only about 15% (range: 4.7-24.3%) of the winter chinook salmon spawner population pass RBDD after 15 May (Snider et al. 1997). With the majority (average approx. 85%) of winter chinook migration occurring outside the season of RBDD operation, the accuracy of spawner estimates based on fish ladder counts are, therefore, highly suspect. The winter chinook salmon spawning ground survey ("carcass survey") has been conducted since 1996 to augment RBDD escapement estimates (Snider et al. 1997, 1998, 1999, 2000). The carcass survey utilizes mark and recapture techniques on carcasses, along with three population estimation models, to calculate estimates of escapement (including bounds of confidence) for winter chinook salmon in the upper Sacramento River. Endangered winter-run chinook salmon delisting criteria calls for a geometric mean cohort replacement rate ≥ 1.0 in addition to abundance $\geq 10,000$ female spawners (Botsford and Brittnacher 1998). These delisting criteria allow for uncertainty partially due to limited accuracy in measuring spawner abundance. Estimates of the

delisting criteria (cohort replacement rate and female spawned abundance) must be based on at least 13 years of data *assuming* that spawner abundance is measured with less than 25% error (Botsford and Brittnacher 1998). It is currently assumed the RBDD run-size estimates do not provide this level of accuracy, and would therefore necessitate a lengthy time extension prior to commencement of delisting due the increased uncertainty in the estimate. Although winter-run chinook salmon population and run-size estimation methodology associated with the mainstem carcass survey are still undergoing refinement, the potential for the generation of a more accurate estimate than those generated at RBDD is promising.

A second fundamental goal of the winter chinook salmon spawning ground survey is to gather information necessary to evaluate the effectiveness of the U.S. Fish and Wildlife Service's winter chinook salmon hatchery supplementation program. In 1988, a Cooperative Agreement was signed between the U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Department of Fish and Game to implement actions to benefit winter chinook salmon in the Sacramento River basin. Within the Cooperative Agreement, signatory agencies identified a ten-point program of responsibilities and actions to be pursued for the protection and rehabilitation of winter chinook salmon. This Cooperative Agreement, often referred to as "The 10-point Plan," identified development of an propagation program along with associated monitoring and evaluation activities as one of several key elements necessary to benefit winter chinook salmon in the Sacramento River basin. Consequently, an artificial propagation of winter chinook salmon was initiated at Coleman National Fish Hatchery in 1988 to ensure the continued existence of Sacramento River winter chinook salmon. Data collected during spawning ground surveys provides the basis of information to monitor, assess, and recommend improvements to the winter chinook salmon supplementation program and other restoration actions identified in the plan.

Likewise, The National Marine Fisheries Service's Draft Recovery Plan for winter-run chinook salmon identified the hatchery supplementation program as a specific action to assist in the recovery of that species (NMFS 1997). The ~~draft~~ plan identified artificial propagation of winter chinook salmon and improved understanding of winter chinook salmon life history and habitat requirements as two actions necessary for the immediate conservation and future recovery of the species. These recovery actions were assigned Priority I (Research of life history and habitat requirements) and Priority III (Artificial Propagation) based on the established priority system (55 FR 24296). In 1998, partly due to information collected in previous mainstem carcass surveys, the winter chinook propagation program was relocated to Livingston Stone NFH. The Livingston Stone NFH was constructed at the base of Shasta Dam in order to improve imprinting/homing and promote integration of hatchery-origin adults with the natural spawning population of winter chinook salmon in the mainstem Sacramento River. Continued assessment of the effectiveness of this supplementation program to contribute to the recovery of endangered winter chinook salmon is dependent upon information gathered through the Sacramento River mainstem carcass surveys. Information collected/analyzed for the purpose of evaluating the hatchery supplementation program includes: abundance of natural- and hatchery-origin spawners; recovery of coded-wire tagged (hatchery origin) winter chinook salmon; and life history attributes (i.e., age structure, sex ratio, pre-spawning mortality, and spawning success) (Snider et al. 1997, 1998, 1999, 2000; USFWS 1996a; Croci and Hamelberg 1997; Croci et al. 2000). The mainstem carcass surveys allow the generation and comparison of cohort replacement rates of natural- and hatchery-origin winter chinook salmon.

The third primary goal of the Sacramento River spawning ground survey is to collect tissue samples. Tissue samples are collected and analyzed to contribute to refinement of genetic tools to discriminate various races of salmon, estimation of effective population size, general genetic

characterization of the winter chinook salmon population, and long-term storage in the CDFG and Service's genetic archives. Funding for the genetic analysis of tissue samples collected during the carcass surveys is being sought through a separate proposal submitted to CALFED directly by the U.C. Davis' Bodega Marine Laboratory.

All Information collected through **this** survey effort will serve to directly assess AFRP restoration goals for winter chinook salmon, determine the effectiveness of the hatchery supplementation program, and assist in maintaining genetic diversity in hatchery and natural stocks. Additionally, the evaluation of winter chinook salmon spawning in the Sacramento River is an integral part of an agreement between the California Department of Fish and Game (DFG) and the U.S. Fish and Wildlife Service's (Service) Central Valley Anadromous Fish Restoration Program (AFRP) to determine habitat requirements for anadromous salmonids. Estimates of spawner abundance generated through the mainstem carcass surveys consistent with this proposal, combined with data collected during concurrent habitat monitoring efforts to identify winter chinook salmon spawning habitat requirements in the upper Sacramento River), contribute to the development of flow recommendations to satisfy requirements of the Central Valley Project Improvement Act, Section 3406(b)(1)(B).

b. Conceptual model

A conceptual model demonstrating the importance of this and other monitoring programs is included on the following page. The model portrays the assumption that restoration actions for winter-run chinook salmon such as those outlined and currently implemented through CVPIA, AFRP and, CALFED, restoration programs will improve degraded habitat conditions that lead to a severely depressed winter-run chinook salmon population. The attached conceptual model also notes the influence of the **1988** Cooperative Agreement signed between the U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Department of Fish and Game to implement actions to benefit winter chinook salmon in the Sacramento River basin. Likewise, the model portrays the Draft Recovery Plan for the Sacramento River Winter-run Chinook Salmon (NMFS **1997**). The need for information regarding winter chinook salmon life-history, spawning habitat requirements, and abundance is identified in the Recovery Plan as necessary for the conservation and recovery of the species. Biological data on the spawner population such as age structure, sex ratio, spawning success, and genetic characterization will be obtained directly through this survey effort. The information gathered through surveys of spawning grounds on the upper Sacramento River is also essential for assessing the effectiveness of artificial propagation in supporting the natural winter chinook salmon population while avoiding potential detrimental genetic and ecological effects. Furthermore, genetic material collected during winter chinook salmon spawning ground surveys contributes substantially toward improved run discrimination technology.

Implementation of all restoration actions are designed to reduce stressors and restore and enhance habitat conditions. However, it is only through extensive field monitoring activities such as that outlined in this proposal which will allow for informed adaptive management decision making. Estimates of abundance derived from the Sacramento River winter-run chinook salmon carcass survey and other intensive surveys, such as the juvenile monitoring program, are useful for monitoring cumulative effects of recovery actions and, in the future, long-term, continuous survey data may be used for considerations regarding achievement of doubling goals and/or to satisfy delisting criteria.

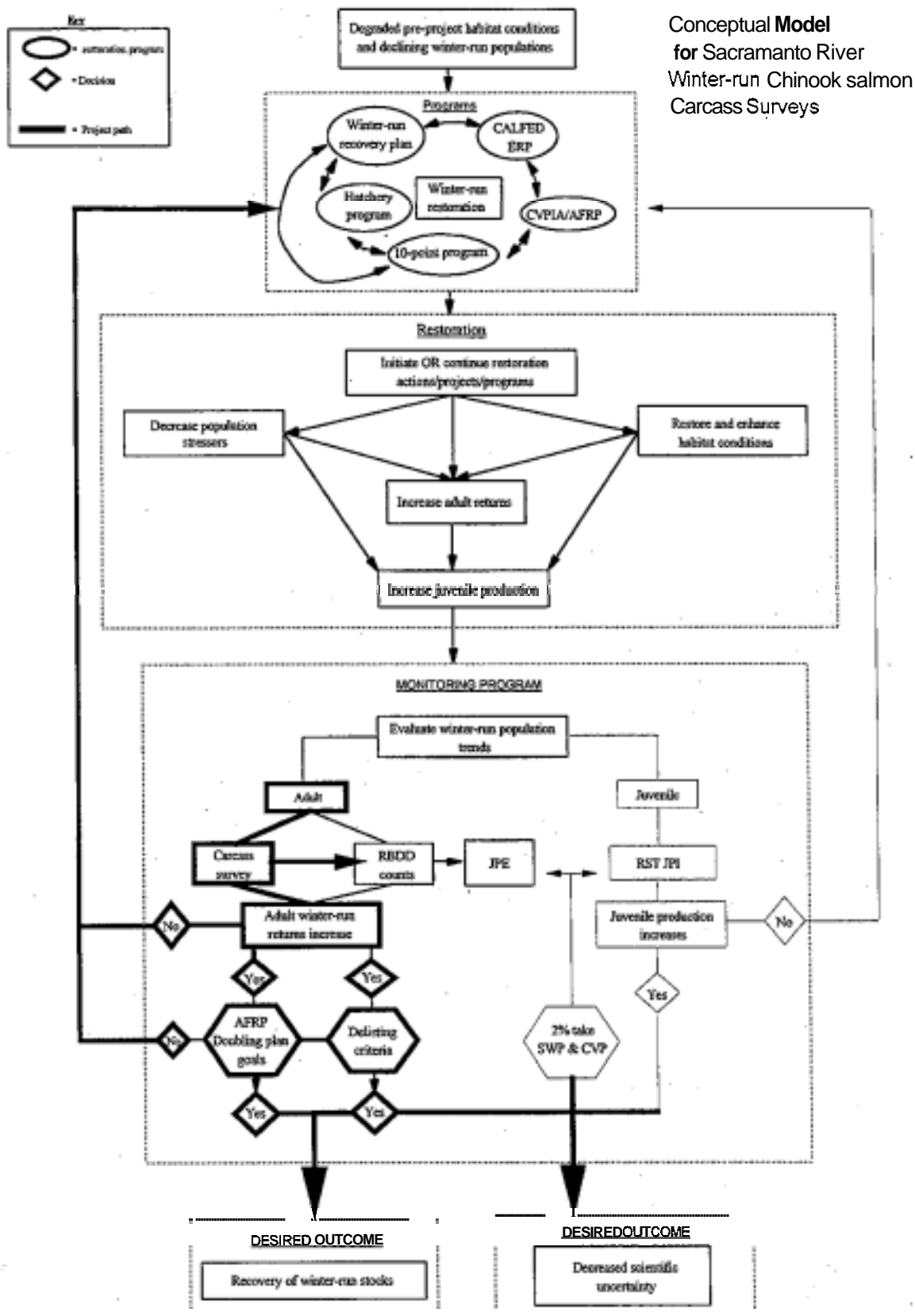


Figure 1. Conceptual Model for Sacramento River winter-run chinook salmon carcass surveys

c. Hypotheses being tested

Information collected during the winter-run chinook salmon mainstem carcass surveys will allow assessment of implemented AFRP, CVPIA and/or CALFED actions and activities. The general hypothesis being tested is that the current run-size estimate is greater than the estimate generated three years previous, assuming an age three maturation schedule for winter-run chinook salmon. Formally stated

H₁: Winter-run chinook salmon run-size estimate at time (t) \geq the run-size estimate at time (t-3).

H₀: Winter-run chinook salmon run-size estimate at time (t) \leq the run-size estimate at time (t-3).

Satisfaction of the null hypothesis would document an increasing trend in the abundance estimate of winter-run chinook salmon and thus support restoration actions and activities as implemented.

Also of prime importance is the development of estimation methodology to satisfy delisting criteria of endangered winter-run chinook salmon:

H₁: Number of winter-run chinook salmon female spawners \geq 10,000 and;

Geometric mean cohort replacement rate \geq 1.0.

H₀: Number of winter-run chinook salmon female spawners $<$ 10,000 and/or;

Geometric mean cohort replacement rate \leq 1.0.

The necessary assumptions to satisfy restrictions of the population estimators suggested for use in this proposal (Jolly Seber and Schaeffer method), have not been met at current population levels (1,000 - 3,000). However, it is expected that at populations levels nearing recovery goals (i.e., approximately 20,000 adults) carcass recovery rates will be sufficient to generate sound estimates within acceptable error rates without increased field effort over that described in this proposal.

Other hypotheses tested **through** this proposal include the verification of the presence of hatchery-origin winter chinook salmon contributing to the natural spawning population.

H₀: Number of hatchery-origin winter-run chinook salmon successfully spawning $>$ 0;

H_a: Number of hatchery-origin winter-run chinook salmon successfully spawning $=$ 0; and;

Through genetic analysis conducted through funding of a separate proposal:

H₁: The genetic variability of the winter-run chinook salmon population at time (t) is \geq the genetic variability at time (t-3).

H_a: The genetic variability of the winter-run chinook salmon population at time (t) is \leq the genetic variability at time (t-3).

Sound ability to measure the above hypotheses fully support Goal 1-Achieve Recovery of At-Risk Species- as presented in the PSP. Sound methodologies with acceptable error rates are essential to document effects of restoration actions and/or achieve delisting criteria.

d. Adaptive Management -

This proposal describes a monitoring activity designed among other objectives to generate a scientifically defensible run-size estimate for endangered winter-run chinook salmon. As stated previously, the current/previous methodology used to generate run-size estimates for winter-run chinook salmon (Red Bluff Diversion Dam ladder counts), can only examine, on average, the last 15% of the run. Much uncertainty exists, however, in expanding this tail end of the run to generate an actual estimate, as it is known that in some years the percentage examined may be as small as 4.7% or as great as 24.3%. The carcass survey as proposed will use mark and recapture techniques on carcasses,

along with three population estimation models, to calculate estimates of escapement (including bounds of confidence) for winter chinook salmon in the upper Sacramento River

Accurate estimation of the number of endangered winter-run chinook salmon that return to the upper Sacramento River is critical to provide a direct measure of the success of AFRP and other management activities intended to directly increase population numbers of salmon and steelhead. Mainstem carcass surveys, executed during May through August have distinct advantages over the Red Bluff Diversion Dam (RBDD) estimation method, in that the entire spawning period is encompassed. The collection of information to allow more accurate estimations of population size and structure, will provide the basis for identifying future management actions necessary to accomplish AFRP goals and listed species recovery and delisting.

e. Educational Objectives - Not Applicable.

2. Proposed Scope of Work

a. Location and/or Geographic Boundaries of the Project

The Sacramento River winter chinook salmon spawning ground survey takes place in Shasta County, from Keswick Dam at river mile (RM) 301 downstream to a powerline below Clear Creek Riffle (RM 292). This area, included in CALFED Ecozone 3.1 (Sacramento River, Keswick Dam to Red Bluff Diversion Dam), contains the majority of available spawning habitat for state and federally listed endangered winter chinook salmon (See Figure 2).

b. Approach

The study defined above section is divided into two reaches: 1) upper reach - Keswick Dam to Cypress Street Bridge (RM 302 to RM 295; and, 2) lower reach - Cypress Street Bridge to Redding Water Treatment Plant (RM 295 to RM 288).

The Sacramento River winter chinook salmon spawning ground survey will occur from approximately May 1 through August 31 annually. This time period accounts for nearly the entire duration of winter chinook salmon spawning (April - mid-August) in the upper Sacramento River. Field surveys are conducted on a 2-day on / 1-day off survey cycle. For example, the upper reach will be surveyed on the first day and the lower reach on the second day of each 2-day survey cycle. Field sampling will not be conducted on the third day of each cycle. This 2-day on / 1-day off cycle will be repeated throughout the entire survey season.

Field sampling procedures and techniques for the Sacramento River winter chinook spawning ground surveys are described below and further explained in Snider et al. (2000). Most of the survey effort is conducted by boat, utilizing two boats and two observers per boat. Beginning at the downstream boundary of the reach being surveyed, survey teams slowly maneuver the boats upstream while observing for salmon carcasses. Observers from each boat are responsible for surveying along one shoreline out to the middle of the river. Several short stretches of river may be surveyed on foot, as a result of low-water conditions that could be hazardous to boat navigation. Survey effort is intended to sample all areas where salmon carcasses could be located, however, efforts tend to be concentrated in areas where carcasses have been shown to collect through previous survey efforts. Observed carcasses are collected using a gaff or gig.

Most collected carcasses are tagged, except those found in an advanced state of decomposition. Fresh carcasses (those with firm flesh and at least one clear eye) are tagged by attaching a small colored plastic ribbon to the upper jaw with a hog ring. The tag color is used to identify the survey period that the carcass was tagged. Similarly colored tags are applied to the lower jaw of slightly

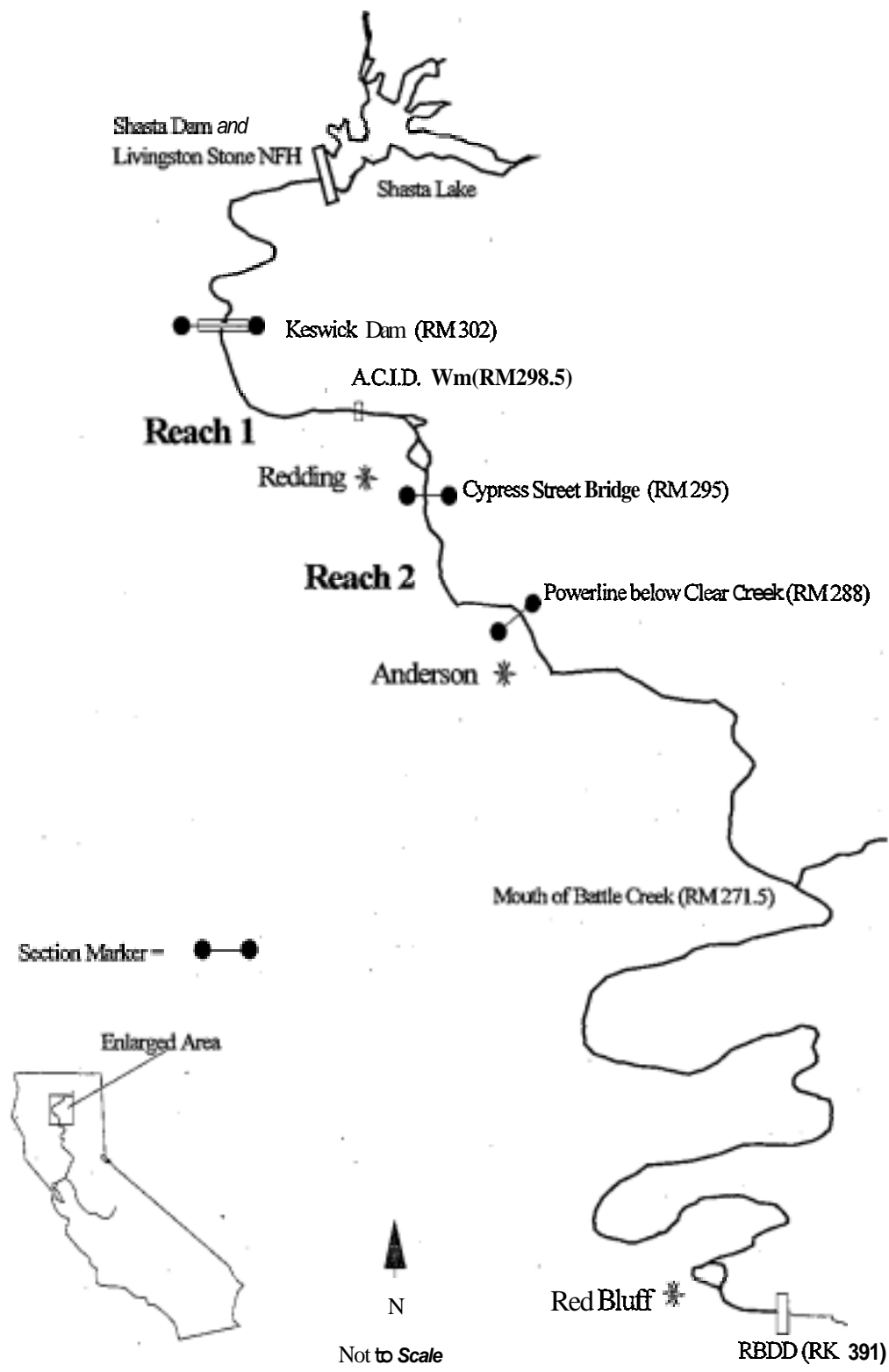


Figure 2. Location of Sacramento River winter chinook salmon carcass survey.

decayed, or non-fresh, carcasses. Carcass condition (fresh or non-fresh) is noted during tagging to accommodate the various population estimators. Carcasses found to be severely decayed are enumerated, cut in **two** (chopped), and disregarded in subsequent surveys. Data and biological samples are collected from non-chopped carcasses, as described below. Following sampling, collected carcasses are returned to a flowing section of the river, near to the location of carcass collection, in effort to simulate natural patterns of carcass distribution.

Data Collection

Collection date and location are recorded for all carcasses encountered. Fork length, sex, and origin (as determined by mark status: ad-clip=hatchery origin, non-clipped=natural origin) are recorded for all except the most severely deteriorated carcasses. Female carcasses are assessed for egg retention to infer spawning success. Females are considered “completely spawned” if few or no eggs remain in the body cavity, “partially spawned” if a substantial amount (50% or more) of eggs remain, or “unspawned” if they appear to have died prior to depositing any eggs. Water temperature and Secchi disk (water clarity) are measured and recorded daily by the survey crew.

Biological Sample Collection

Biological samples of tissues and scales will be collected from most salmon carcasses encountered during spawning ground surveys. Several samples of soft tissue are collected from the least-decayed area (most often fin or operculum) of most salmon carcasses collected during spawning ground surveys. Tissues are generally not collected from severely deteriorated carcasses because highly-degraded tissues are not useable for genetic analysis. Scales are collected for determination of age composition. Additionally, the head will be collected from adipose fin-clipped (hatchery-origin) carcasses. Coded-wire tags (CWT) are subsequently extracted in the laboratory and read to identify the hatchery of origin.

Population Estimation Methodology

Carcass mark-and-recapture surveys have been routinely used to estimate escapement to Sacramento Valley tributary streams (e.g., American, Yuba, and Feather rivers and Battle Creek). This method was initially used in the Central Valley to estimate the 1973 Yuba River escapement (Taylor 1974).

Carcass mark-and-recapture techniques have been used to estimate winter chinook escapement in the Sacramento River since 1996 (Snider et al. 1997).

Three models have been used by the California Department of Fish and Game to estimate escapement from carcass tag-and-recovery data; Petersen (Ricker 1975), Schaefer (1951), and Jolly-Seber (Seber 1982) models. Boydstun (1994) and Law (1994) tested and compared accuracy and precision of these estimators using field-testing and simulated trials, respectively. The Petersen formula is the simplest but least accurate (Law 1992) and has been used primarily when data are insufficient to allow calculation with other models. Law (1992) found that the Petersen model consistently showed substantially larger overestimation than either the Schaefer or Jolly-Seber models.

A modified Schaefer model (Taylor 1974) has been used in “larger” Central Valley tributary streams since 1973 when it was first used to estimate escapement in the Yuba River. The Jolly-Seber model was first used in the Central Valley in 1988 to estimate escapement in the Feather, Yuba, American, Stanislaus, Tuolumne, and Merced rivers. While the Schaefer and Jolly-Seber models are generally considered more accurate than the Petersen estimator, a fundamental requirement of the Schaefer and Jolly-Seber models is that tagged fish be recovered during each survey period. This condition has not been satisfied during past survey efforts on the Sacramento River winter chinook salmon carcass survey as a result of low levels of winter chinook abundance (range of Petersen estimates: 820 [1996] to 5,501 [1998]) and relatively low rates of recapture (range: 12% [1997] to 22% [1999]). Therefore, the Petersen formula, using fresh carcass data, has been utilized for calculating winter chinook salmon

population estimates since 1996. Although the Petersen formula likely overestimates true abundance, data will likely be available every year to permit calculation of a Petersen estimate, thus allowing for a determination of population trends, unlike the Schaefer and Jolly-Seber models. However, for future years, if we consider a recovering population of winter chinook salmon, then it is likely that requirements of the Schaefer and Jolly-Seber population estimation models will be satisfied. Under this circumstance, these models will be utilized, in combination with the Petersen model, to provide estimates of abundance with increased accuracy and precision. The Department of Fish and Game will continue to refine and enhance survey techniques and statistical methodologies of population estimation using carcass mark-and recovery data.

c. Monitoring and Assessment Plans

The complete proposal as submitted details a monitoring project.

d. Data Handling and Storage

All hard copy data sheets will be retained in office files. Electronic databases will be constructed from field data and will be available from the U.S. Fish and Wildlife Service and/or the California Department of Fish and Game upon completion of required written products.

e. Expected Products/Outcomes

Two annual reports will be generated describing field activities. The California Department of Fish and Game will produce a report that estimates escapement, examines the feasibility of using mark-and-recapture techniques, and describes baseline information on spawning distribution (temporal), environmental conditions at the time of spawning, and size, sex, and success of the spawning population. The Service will generate a report evaluating the winter chinook salmon hatchery propagation program which will include tracking information of genetic samples collected.

f. Work Schedule

The Sacramento River winter-run chinook salmon carcass survey will generally begin on the 1st of May and continue through the end of August. Time frames for all project components as part of Tasks 1 and 2 are presented in Table 1 below. Although Tasks 1 and 2 are separate lines in the budget table (see Section F. Cost), they are actually inseparable and simply denote costs associated with the U.S. Fish and Wildlife Service's aspect of the survey (Task 1), and the California Department of Fish and Game's aspect of the survey (Task 2). Funding and participation of both agencies is critical to meet objectives as presented in this proposal.

Table 1.—Time frame for all project components as part of Tasks 1 and 2.

Tasks 1 and 2	J	F	M	A	M	J	J	A	S	O	N	D
Project set up				X								
Data collection					X	X	X	X				
Report writing									X	X	X	
Complete report												X

g. Feasibility

The Service and CDFG have been cooperatively conducting winter chinook salmon carcasses surveys since 1996. Since inception of the joint project, field crews have likely encountered and remedied potential problems or difficulties associated with the monitoring program as described. Inhospitable environmental conditions are always a potential problem but flexibility has been accounted for in the sampling regime. Design constraints and economic impacts are minimal if non-existent. The project has proven successful in generating escapement estimates, suggesting alternatives to hatchery practices and providing samples for genetic analysis. Funding levels as requested through this proposal are expected to be adequate to generate appropriate data. Analytical methodologies are expected to be refined over time to generate run-size estimates with acceptable error rates. These methodology changes may necessitate increased field effort to meet assumptions associated/necessary for the generation of estimates through various population estimators (Jolly Seber and Schaeffer method). Although, it *is* expected that current field efforts will be sufficient to generate sound estimates due to increasing number of carcass recoveries associated with increases of abundance (see Hypotheses Tested Section above). Previous supplemental funding requests have been made by CDFG, and may, in fact, be made in the future for additional field sampling activities. Additional activities identified include: snorkeling, SCUBA, and radio tagging, in effort to increase the number of carcasses recovered.

**D. APPLICABILITY TO CALFED ERP GOALS AND
IMPLEMENTATION PLAN AND CVPIA PRIORITIES.**

1. ERP Goals and CVPIA Priorities.

This project will provide information to document the number of hatchery- and natural-origin winter chinook salmon that return to the upper Sacramento River. Abundance estimates of hatchery- and natural-origin winter chinook salmon resulting from this survey have been generated since 1996 to monitor and assess progress toward goals of the Anadromous Fish Restoration Program (AFRP), the CALFED Bay-Delta Program, the Proposed Recovery Plan for the Winter-run Chinook Salmon, and the "10-Point Plan" to benefit winter chinook salmon. Continuation of the winter chinook salmon spawning ground survey for estimating winter chinook spawner abundance is necessary for continuity in estimation methodology, and to augment questionable estimates spawner abundance generated by fish counts past RBDD.

This survey, as described in this proposal, is designed estimate spawner abundance, which can be used to measure population-level responses (in terms of population size) to cumulative management actions implemented under CALFED, CVPIA, and AFRP. In addition to population level responses, biological information *will* be collected on individual fish to monitor potential effects on life-history characteristics in response to recovery actions. The following section describes how the winter chinook salmon spawning ground survey will contribute to monitoring progress toward selected goals and priorities of several key restoration programs. Relationships between restoration and supplementation programs and the winter chinook carcass survey are further described in Sections 1(b) and 1(d) which present a conceptual model how information gained through this effort can be used as feedback in an adaptive management framework.

Anadromous Fish Restoration Program

Because of their ESA listing status, Sacramento River winter chinook salmon are considered a high-priority, special status species of the AFRP. To accomplish the AFRP doubling goal, the Department of the Interior has implemented numerous programs to improve environmental conditions and modified operations, management, and physical facilities of the CVP.

Monitoring, **using** standardized and validated methods, is essential to obtain data on anadromous fish production and habitats which is used to evaluate the effects of restoration actions. One of the six primary objectives of the AFRP, determined to be important in achieving the overall program goal, is to "[D]evelop fish population, health, and habitat data to facilitate evaluation of restoration actions." Data generated through the Sacramento River spawning ground survey provide arguably the best information available to evaluate effectiveness of restoration actions on winter chinook salmon spawner abundance. Continuation of this program is recommended in the Final Draft Anadromous Fish Restoration Plan (USFWS 1996b), and is considered essential for evaluating the cumulative (systemwide) and long-term effects of AFRP actions taken to double natural production.

Aside from directly the ability to measure achievement of the doubling goal, other aspects of the Anadromous Fish Restoration Program Plan that are supportive of this project: Central Valley-Wide Evaluation #2: *Evaluate the potential to modify hatchery procedures to benefit native stocks of salmonids*; and Central Valley-Wide Evaluation #4: *Evaluate and implement specific hatchery spawning protocols and genetic evaluation programs to maintain genetic diversity in hatchery and natural stocks*.

CALFED Bay-Delta Program

Ecosystem monitoring is identified as a critical step of the ERPP process, providing essential feedback about how the biological system responds to restoration efforts and providing a means to adjust future actions through adaptive management. The success of restoration efforts must ultimately be evaluated through measurement of population-level responses. Ecosystem Restoration Strategic Goal 1 of the CALFED Bay-Delta program places highest priority on restoring populations of at-risk, ESA-listed species, such as winter chinook salmon, which most strongly affect the operation of the State Water Project and Central Valley Project diversions in the south Delta. Ultimately, the time-line for satisfying delisting criteria for winter chinook salmon is dependent upon the accuracy of population estimates using standard methods. For winter chinook salmon, population estimation using information derived from the Sacramento River spawning ground survey is critical to gauge progress toward achieving recovery goals.

2. Relationship to Other Ecosystem Restoration Projects.

As Explained above and in the conceptual model the project as described has the potential to document the effectiveness of past and future CALFED, AFRP, CVPIA and other ecosystem restoration activities.

3. Requests for Next-Phase Funding.

See Appendix I

4. Previous Recipients of CALFED or CVPIA funding.

The U.S. Fish and Wildlife Service has previously received funding for this project through an AFRP entitled *Expanded winter-run chinook salmon carcass survey: Upper mainstem Sacramento River*. The Department of Fish and Game has also received previous funding for this project through AFRP and CVPIA. The title of CDFG's AFRP proposal is: *Winter-run chinook salmon escapement survey, Sacramento River*. Other funding for CDFG was secured through CVPIA/AFRP as part of the AFRP project entitled: *Continue to conduct instream flow studies on the Sacramento, American, and Merced rivers*. See Appendix I for status update.

5. System-Wide Ecosystem Benefits.

As explained above the project as described has the potential to document the effectiveness of past and future CALFED, AFRP, CVPIA and other ecosystem restoration activities. Additionally, this program intimately ties into other projects also requesting funding through this PSP. While this project is largely aimed at developing a run-size estimate for endangered winter-run chinook salmon, a juvenile monitoring program executed by the U.S. Fish and Wildlife Service at the Red Bluff Diversion Dam will attempt to corroborate run-size estimates with juvenile production estimates (JPE). Upon generation of a precise JPE, general life-history production models can be used to generate estimates of egg deposition and contributing numbers of females which can be compared to run-size estimates generated through carcass surveys and Red Bluff Diversion Dam fish ladder counts. In combination, the carcass survey results and the JPE will result in a reduction in scientific uncertainty, and can be used to assess success of spawner contribution leading to a more complete measure of habitat productivity.

The carcass survey project as described in this proposal also supports investigations into the genetic variability of endangered winter-run chinook salmon by collecting large numbers of tissue samples of this endangered species. These samples will be analyzed through a proposal submitted by U.C. Davis' Bodega Marine Laboratory. Tissue samples collected through the mainstem carcass surveys will go to support measurements of effective population size and population genetic integrity, as outlined in Bodega Marine Laboratory's proposal.

E. QUALIFICATIONS.

U.S. Fish and Wildlife Service Applicant Qualifications

James G. Smith.-Mr. Smith is the Project Leader at the Service's Northern Central Valley Fish and Wildlife Office (NCVFWO) in Red Bluff, California. The NCVFWO has been extensively involved with monitoring chinook salmon in the Northern Sacramento River since 1978, and has been involved in the Sacramento River winter-run chinook salmon carcass survey since 1994. The office is staffed with approximately 40 personnel, and has responsibilities that include identifying and defining factors affecting the abundance and survival of anadromous salmonids in the Sacramento River Basin. **Mr.** Smith has a B.S. from Humboldt State University (1975) and conducted post-graduate study in Fisheries also from Humboldt State University (1976-1979). **Mr.** Smith has been with the U.S. Fish and Wildlife Service for 21 years, and for the past 17 years, has been involved with numerous fishery studies directly in the upper Sacramento River (e.g., investigations at RBDD, monitoring juvenile outmigrants, hatchery evaluation efforts at Coleman NFH, Battle Creek restoration, and mainstem Sacramento River spawning gravel evaluations). **Mr.** Smith works on a daily basis with numerous federal, state, and private entities in developing actions and programs for restoring, conserving, and enhancing anadromous salmonids in the upper Sacramento River.

Scott Hamelberg- Mr. Hamelberg has a B.S. in Environmental Science from Northland College (1983). He has been with the U.S. Fish and Wildlife Service for 17 years, 9 of which have been out of the Red Bluff office where he is the Assistant Project Leader. His main responsibilities include the evaluation of Coleman and Livingston Stone NFHs and involvement in the winter-run chinook salmon propagation and captive breeding programs. The mainstem Sacramento River carcass surveys have been conducted out of the Hatchery Evaluation program led by Mr. Hamelberg.

The California Department of Fish and Game Applicant Qualifications

Bill Snider-- Project co-manager. **Mr.** Snider is a graduate of the University of California at Davis and has 28 years of experience with DFG, including 20 years experience with the Stream Evaluation Program. During the past four years, **Mr.** Snider has been the project manager of the Sacramento River stream habitat evaluation project while the project has conducted annual spawner escapement surveys on winter run as well as fall and late-fall run.

Robert Reavis- Project co-leader. **Mr.** Reavis is a graduate of Humboldt State University and has 34 years experience with DFG including regional salmon management coordinator and district biologist for the anadromous fisheries within Region 2. **Mr.** Reavis has over 25 years experience in conducting, coordinating and leading salmon escapement surveys throughout the Central Valley.

Scott Hill- Oversee field activities. **Mr.** Hill is a graduate of Humboldt State University and has 8 years of experience with the DFG. **Mr.** Hill has been the principle field investigator on the Sacramento River stream habitat evaluation project for the past 4 years during which time he has conducted salmon escapement surveys for winter, fall and late-fall run.

F. COST

1. Budget.

See Table 2 for a detailed budget for each year of requested support, and a summary budget detailing requested support for the overall project period (3 years). This project, however, should be expected to go substantially into the future to monitor the response of endangered winter-run chinook salmon abundance as a result of actions and activities implemented under AFRP, CVPIA, CALFED, and/or other restoration.

Please note that in examination of the budget Task 1 and 2 are inseparable and simply denote the funding required by the U.S. Fish and Wildlife Service (Task1) and the California Department of Fish and Game (Task 2). Upon approval of this proposal, a Cooperative Agreement will be developed between the U.S. Fish and Wildlife Service and the California Department of Fish and Game to provide a mechanism for the funding transfer. Detail of Salary and benefit breakdowns are displayed in Tables 3 and 4.

Motor Boat Operators Training is required for Fish and Wildlife Service employees and is estimated at \$1,000 in the initial year. Supplies and expendable materials for both agencies include boat gas and oil, life vests, gigs or gaffs, and tissue vials. Other equipment includes vehicle lease, and partial funding for a project computer.

Budget computations for U.S. Fish and Wildlife Service participation (Task 1) include an inflation rate of 4% is applied across the board for years 2 and 3, while at 5% infaltion rate is used in budget computations for California Department of Fish and Game (Task 2).

2. Cost-Sharing. None

Table 2.-Annual and Total Budget

Year	Task	Subject to Overhead						Total Cost
		Salary and Benefits	Training Travel and Per Diem	Vehicle Gas and Mileage Supplies & Expendables	Equipment Including Vehicle and Computer Purchases	Service Contracts	Overhead	
Year 1	Task 1	\$36,480	\$1,000	\$6,900	\$3,000	\$0	\$1,421	\$48,801
	Task 2	\$29,356	\$0	\$5,200	\$2,000	\$0	\$8,4081	\$44,9641
Total Cost Year 1		\$65,836	\$1,000	\$12,100	\$5,000	\$0	\$9,829	\$93,765
Year 2	Task 1	\$43,263	\$1,040	\$7,176	\$3,120	\$0	\$1,638	\$56,237
	Task 2	\$30,824	\$0	\$5,460	\$2,100	\$0	\$8,828)	\$47,212)
Total Cost Year 2**		\$74,087	\$1,040	\$12,636	\$5,220	\$0	\$10,466	\$108,449
Year 3	Task 1	\$44,994	\$1,082	\$7,463	\$3,245	\$0	\$1,703	\$58,486
	Task 2	\$32,365	\$0	\$5,733	\$2,205	\$0	\$9,2701	\$47,5731
Total Cost Year 3***		\$77,359	\$1,082	\$13,196	\$5,450	\$0	\$10,973	\$108,059
Total Project Cost		\$217,281	\$3,122	\$37,932	\$15,670	\$0	\$31,269	\$305,273

* Task only denotes split cooperation between U.S. Fish and Wildlife Service (Task 1), and California Department of Fish and Game (Task 2)

** Overhead for U.S. Fish and Wildlife Service shown at 3%.

Overhead for California Department of Fish and Game calculated at 23%

***Cost of living increases calculated at 4% for U.S. Fish and Wildlife Service, and 5% for California Department of Fish and Game

Table 3- U.S. Fish and Wildlife Salary and Benefit costs associated with carcass survey by position

Task 1Near 1	Position*	Annual Salary	Annual Benefits	Total	Time (Years)	TOTAL
	GS-5	\$23,731.76	\$1,827.35	\$25,559.11	0.333	\$8,511.18
	GS-5	\$23,731.76	\$1,827.35	\$25,559.11	0.333	\$8,511.18
	GS-7	\$29,395.60	\$2,263.46	\$31,659.06	0.167	\$5,287.06
	GS-9	\$38,355.20	\$10,547.68	\$48,902.88	0.100	\$4,890.29
	GS-11	\$46,407.92	\$12,762.18	\$59,170.10	0.050	\$2,958.50
	Other	\$34,254.95	\$7,887.29	\$42,142.24	0.150	\$6,321.34
					1.133	\$36,479.58
Task 1Near 2	Position*	Salary	Benefits	Total	Time	TOTAL
	GS-5	\$25,503.05	\$6,324.76	\$31,827.80	0.333	\$10,598.66
	GS-5	\$25,503.05	\$6,324.76	\$31,827.80	0.333	\$10,598.66
	GS-7	\$31,589.21	\$7,834.12	\$39,423.33	0.167	\$6,583.70
	GS-9	\$39,889.41	\$10,969.59	\$50,859.00	0.100	\$5,085.90
	GS-11	\$48,264.24	\$13,272.67	\$61,536.90	0.050	\$3,076.85
	Other	\$35,625.15	\$8,202.78	\$43,827.93	0.167	\$7,319.26
					1.150	\$43,263.02
Task 1Near 3	Position*	Salary	Benefits	Total	Time	TOTAL
	GS-5	\$26,523.17	\$6,577.75	\$33,100.91	0.333	\$11,022.60
	GS-5	\$26,523.17	\$6,577.75	\$33,100.91	0.333	\$11,022.60
	GS-7	\$32,852.78	\$8,147.49	\$41,000.27	0.167	\$6,847.04
	GS-9	\$41,484.98	\$11,408.37	\$52,893.36	0.100	\$5,289.34
	GS-11	\$50,194.81	\$13,803.57	\$63,998.38	0.050	\$3,199.92
	Other	\$37,050.15	\$8,530.90	\$45,581.05	0.167	\$7,612.03
					1.150	\$44,993.54

* All "GS" positions are fishery biologists. Other includes: administrative officer, office automation clerk, maintenance worker, etc.. Includes 4% cost of living adjustment for years 2 and 3. GS-5 and 7 positions also reflect change from "Temp" to "Term" status in years 2 and 3.

Table 4--California Department of Fish and Game salary and benefit costs associated with Carcass survey by position

Task 2/Year 1	Position	Annual Salary	Annual Benefits	Total	Time (Years)	TOTAL
	Sci Aid	\$23,812.00	\$1,810.00	\$25,622.00	0.333	\$8,532.13
	Sci Aid	\$23,812.00	\$1,810.00	\$25,622.00	0.333	\$8,532.13
	Sci Aid	\$23,812.00	\$1,810.00	\$25,622.00	0.333	\$8,532.13
	Sci Aid	\$23,812.00	\$1,810.00	\$25,622.00	0.150	\$3,843.30
					1.15	\$29,439.68
Task 2/Year 2	Position	Salary	Benefits	Total	Time	TOTAL
	Sci Aid	\$25,002.60	\$1,900.50	\$26,903.10	0.333	\$8,958.73
	Sci Aid	\$25,002.60	\$1,900.50	\$26,903.10	0.333	\$8,958.73
	Sci Aid	\$25,002.60	\$1,900.50	\$26,903.10	0.330	\$8,878.02
	Sci Aid	\$25,002.60	\$1,900.50	\$26,903.10	0.150	\$4,035.47
					1.15	\$30,830.95
Task 2/Year 3	Position	Salary	Benefits	Total	Time	TOTAL
	Sci Aid	\$26,252.73	\$1,995.53	\$28,248.26	0.333	\$9,406.67
	Sci Aid	\$26,252.73	\$1,995.53	\$28,248.26	0.333	\$9,406.67
	Sci Aid	\$26,252.73	\$1,995.53	\$28,248.26	0.333	\$9,406.67
	Sci Aid	\$26,252.73	\$1,995.53	\$28,248.26	0.150	\$4,237.24
					1.15	\$32,457.24

Includes 5% cost of living adjustment for years 2 and 3; salary \$11.41/hr and benefits at 7.65% in year 1 is at top of scientific aid scale.

G. LOCAL INVOLVEMENT

CDFG shares equally in the implementation of this project with the Service at NCVFWO. Instead of a single local watershed group with an interest in this project, this mainstem Sacramento River project is broadly supported by multiple watershed groups throughout the Sacramento River Watershed. This project does not contribute to development or implementation of any specific locally led watershed planning efforts, however, the reports of the winter-run chinook salmon mainstem carcass survey are of interest to many local watershed groups (e.g. Clear Creek, Cow Creek, Cottonwood Creek, Battle Creek).

H. COMPLIANCE WITH STANDARD TERMS AND CONDITIONS

The Fish and Wildlife Service (Service) cannot agree to a standard clause requested for State funded projects. Attachment D, Terms and Conditions for State Proposition 204 Funds, Section 3, states "Performance Retention: Disbursements shall be made on the basis of costs incurred to date, less ten percent of the total invoice amount. Disbursement of the ten percent retention shall be made either: (1) upon the Grantee's satisfactory completion of a discrete project task (ten percent retention for task will be reimbursed); or (2) upon completion of the project and Grantee's compliance with project closure requirements specified by CALFED (ten percent retention for entire project will be disbursed)".

The Service's authorization to enter into agreements with non Federal entities was changed in FY 2000. Our FY2000 Appropriations bill authorizes the Service to enter into contracts with State agencies when advance payment to the Service is not possible. In accordance with the requirements imposed by Congress in the FY2000 Appropriations bill and report language, the Services Director must approve a project when advance payment is not possible and certify that payments will be made in full by the State within 90 days after the Service issues an invoice. Specifically, the 10% retention clause cannot allow timely payments for the following reasons:

In our Federal Financial System (FFS) accounting program, a periodic invoice (either quarterly or monthly depending on the terms of the contract) is automatically issued from our finance center based on actual expenditures of the Service on a project. Invoices include a payment due date on the invoice and when payment is not received in full by that due date, the system automatically shows the unpaid balance as delinquent. Depending on how delinquent the payment is, interest, penalty and administrative charges may also accrue. With 10% retention withheld on each invoice, the 10% retention amount then causes applicable invoice record in FFS to be partly delinquent and remain delinquent until the project or individual tasks identified in the contract are completed and the retention is released.

The Service's Finance Center must report to the Department of Treasury if the Service is owed funds by any entity. Therefore, when accounts remain delinquent due to the 10% retention of payments owed the Service, that delinquency continues to be reported to Treasury.

The Service has previously entered into agreements with the State of California that do not contain the 10% retention clause.

We have asked the States Deputy Attorney General (see attached letter) to provide clarifying guidance to the Department of Water Resources that is general in scope, which can also be applied to contracts related to the CALFED program.

Our offices will continue to work with the State closely on State funded projects. If the State is not satisfied with the work performed by the Service, the State project manager should contact the Service's project manager to correct the performance problem. If needed, upon notification interim billings can be canceled until the State is satisfied with the Services performance. We can comply with all other State and Federal standard clauses.

I. LITERATURE CITED (Page 1 of 2)

- Botsford, L.W., J.G. Brittnacher. 1998. Viability of Sacramento River winter-run chinook salmon. *Conservation Biology* 12(1):65-79.
- Boydston, L.B. 1994. Analysis of two mark-recapture methods to estimate the fall chinook salmon (*Oncorhynchus tshawytscha*) spawning run in Bogus creek, California. *Calif. Fish & Game* 80(1):1-13.
- Croci, S.J. and S. Hamelberg. 1997. Evaluation of the Sacramento River winter chinook salmon (*Oncorhynchus tshawytscha*) propagation program in 1996. U.S. Fish and Wildlife Service, Northern Central Valley Fish and Wildlife Office, Red Bluff, CA.
- Croci, S.J., S. Hamelberg, V. Free, J. Jahn, and R. Rickert. 2000. **Draft:** Evaluation of the Sacramento River winter chinook salmon (*Oncorhynchus tshawytscha*) propagation program in 1997. U.S. Fish and Wildlife Service, Northern Central Valley Fish and Wildlife Office, Red Bluff, CA.
- Law, P.M.W. 1994. A simulation study of salmon carcass survey by capture-recapture method. *Calif. Fish & Game* 80(1):14-28.
- NMFS. 1997. Proposed recovery plan for the Sacramento River winter-run chinook salmon. Nat. Marine Fish. Serv., Southwest Region, Long Beach, CA 228 p.
- Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Canada Dept. of Environ., Fish. And Mar. Serv. Bull. 191:382p.
- Seber, G.A.F. 1982. The estimation of animal abundance and related parameters. 2nd. MacMillan, New York, N.Y. 654 p.
- Snider, B., B. Reavis, S. Hamelberg, S. Croci, S. Hill, and E. Kohler. 1997. 1996 Upper Sacramento River winter-run chinook salmon escapement survey. Calif. Dept. Fish & Game, Stream Flow & Habitat Evaluation Program, Envir. Serv. Div.
- Snider, B., B. Reavis, and S. Hill. 1998. 1997 Upper Sacramento River winter-run chinook salmon escapement survey. Calif. Dept. Fish & Game, Stream Evaluation Program, Envir. Serv. Div.
- Snider, B., B. Reavis, and S. Hill. 1999. 1998 Upper Sacramento River winter-run chinook salmon escapement survey, May-August 1998. Calif. Dept. Fish & Game, Stream Evaluation Program, Habitat Conservation Division.
- Snider, B., B. Reavis, and S. Hill. 2000. 1999 Upper Sacramento River winter-run chinook salmon escapement survey May-August 1999. Calif. Dept. Fish & Game, Stream Evaluation Program, Habitat Conservation Division.
- Taylor, S. N. (Editor). 1974. King (chinook) salmon spawning stocks in California's Central Valley, 1973. Calif. Dept. Fish & Game, Anad. Fish. Admin. Rep. No. 74-12. 32p.

I. LITERATURE CITED (Page 2 of 2)

- USFWS. 1996a. Escapement of hatchery-origin winter chinook salmon (*Oncorhynchus tshawytscha*) to the Sacramento River, California in 1995, with notes on spring chinook salmon in Battle Creek. U.S. Fish and Wildlife Service, Northern Central Valley Fish and Wildlife Office, Red Bluff, CA.
- USFWS. 1996b. Final draft anadromous fish restoration plan - A plan to increase natural production of anadromous fish in the Central Valley of California. Prepared for the Secretary of the Interior by the U.S. Fish and Wildlife Service with assistance from the Anadromous Fish Restoration Program Core group. Stockton, CA.

Other Applicable Publications

- Hedrick, P.W., D. Hedgecock, S. Hamelberg, and S.J. Croci. 2000. The impact of supplementation in winter-run chinook salmon on effective population size. The American Genetic Association 91:112-116.
- Hedrick, P.W., D. Hedgecock, and S. Hamelberg. 1995. Effective population size in winter-run chinook salmon. Conservation Biology. 9:615-624.

ENVIRONMENTAL COMPLIANCE CHECKLIST

1. Do any of the actions included in the proposal require compliance with either the California Environmental Quality Act (CEQA), the National Environmental Policy Act (NEPA), or both?

YES.

2. If you answered yes to # 1, identify the lead governmental agency for CEQA/NEPA compliance. **Fish and Wildlife Service.**

3. If you answered no to # 1, explain why CEQA/NEPA compliance is not required for the actions in the proposal. **NA see # 1.**

4. If CEQA/NEPA compliance is required, describe how the project will comply with either or both of these laws. Describe where the project is in the compliance process and the expected date of completion. **The type of proposed monitoring projects are cateorically excluded in the Fish and Wildlife Service Departmental Manual at 516 DM 6 Appendix 1.4 Categorical Exclusions Section B. Resource Management: (1) Research, inventory, and information collection activities directly related to the conservation of fish and wildlife resources.**

5. Will the applicant require access across public or private property that the applicant does not own to accomplish the activities in the proposal? If yes, the applicant must attach written permission for access from the relevant property owner(s). Failure to include written permission for access may result in disqualification of the proposal during the review process. Research and monitoring field projects for which specific field locations have not been identified will be required to provide access needs and permission for access with 30 days of notification of approval. **No.**

6. Please indicate what permits or other approvals may be required for the activities contained in your proposal. Check all boxes that apply.

Conditional use permit ____

Variance ____

Subdivision Map Act approval ____

Grading permit ____

General plan amendment ____

Specific plan approval ____

Rezone ____

Williamson Act Contract cancellation

Other ____ (please specify)

None required ____

STATE

CESA Compliance XXX

Streambed alteration permit ____

CWA § 401 certification ____

Coastal development permit ____

Reclamation Board approval ____

Notification ____

Other- Scientific Collection permit

None, required ____

FEDERAL

ESA Consultation XXX (NMFS)

Rivers & Harbors Act permit ____

CWA § 404 permit ____

Other ____ (please specify)

None required ____

LAND USE CHECKLIST

1. Do the actions in the proposal involve physical changes to the land(i.e. grading, planting vegetation, or breeching levees) or restrictions in land use (i.e. conservation easement or placement of land in a wildlife refuge)? NO.
2. If NO to # 1, explain what type of actions are involved in the proposal (i.e., research only, planning only). The monitoring projects will not involve physical changes to the land.
3. If YES to # 1, what is the proposed land use change or restriction under the proposal? NA see # 1.
4. If YES to # 1, is the land currently under a Williamson Act contract? NA see # 1.
5. If YES to # 1, answer the following: current land use, current zoning, current general plan designation: NA see # 1.
6. If YES to #1, is the land classified as Prime Farmland, Farmland of Statewide Importance or Unique Farmland on the Department of Conservation Important Farmland Maps? NA see # 1.
7. If YES to # 1, how many acres of land will be subject to physical change or land use restrictions under the proposal? NA see # 1.
8. If YES to # 1, is the property currently being commercially farmed or grazed? NA see # 1.
9. If YES to #8, what are the number of employees/acre, the total number of employees NA see # 1.
10. Will the applicant acquire any interest in land under the proposal (fee title or a conservation easement)? NO.
11. What entity/organization will hold the interest? NA see # 1.
12. If YES to # 10, answer the following total number of acres to be acquired under proposal, number of acres to be acquired in fee, number of acres to be subject to conservation easement. NA see # 10.
13. For all proposals involving physical changes to the land or restriction in land use, describe what entity or organization will manage the property, provide operations and maintenance services, conduct monitoring. NA see # 10.
14. For land acquisitions (fee title or easements), will existing water rights be acquired? NA see # 10.
15. Does the applicant propose any modifications to the water right or change in the delivery of the water? NA see # 10.
16. If YES to # 15, describe. NA see # 10.

Section D

3. Requests for Next-Phase Funding

Status/history of generation of winter-run chinook salmon run-size estimates. AFRP/CVPIA began funding the survey in 1996.

1971-1986

Red Bluff Diversion Dam (RBDD) (RM 243) was in year-round operation (i.e. gates are down -- causing a low head dam to divert a portion of the Sacramento River down the Tehama-Colusa Canal). Winter chinook salmon escapement estimates were based on counts at the three fish ladders that provide passage around the dam. These counts encompassed the entire winter chinook salmon migration period (December through early July) allowing a complete accounting of the winter chinook salmon escapement.

1987 A major effort to restore winter chinook salmon populations consisted of operational changes to RBDD. Instead of the dam gates at RBDD being in operation all year (i.e. migration barrier), the dam gates are only lowered into operation from May through September. This improves conditions for adult and juvenile salmonid passage at the dam, but the ability to effectively estimate escapement of all runs of salmon was greatly reduced.

1988 The Service entered into a mutual agreement with National Marine Fisheries Service, U.S. Bureau of Reclamation, and CDFG to develop a winter chinook hatchery propagation program at the Service's Coleman National Fish Hatchery, located on Battle Creek. This program was established to ensure the continued existence of the Sacramento River winter chinook salmon. The goal of the propagation program was to supplement natural spawning while avoiding the development of an adult return to the hatchery.

1994 A pilot winter-run chinook salmon carcass survey on the mainstem Sacramento River began as a means to evaluate the winter chinook salmon propagation program and to collect tissue samples for genetic analysis. During this initial year, minimal effort was afforded by conducting boat surveys to locate carcasses particularly around Turtle Bay (RM 298). Also, boats were deployed to recover carcasses observed during weekly aerial flights from May through August to count winter chinook salmon redds: Twelve carcasses were recovered in 1994, which accounted for approximately 6% of the estimated run past Red Bluff Diversion Dam (RBDD). No hatchery-origin winter chinook salmon were observed.

1995 The Service put forth more effort to recover winter chinook salmon carcasses to determine the success of the propagation program, and collect tissues for genetic characterization of the winter-run chinook salmon population for run discrimination work and in support of the propagation program. One boat with two people went out once a week to look for carcasses in the Redding area from May through August. A total of approximately 117 winter chinook salmon carcasses were recovered amounting to 8.6% of the estimated run size past RBDD. Again, no hatchery origin winter chinook salmon were observed.

Section D

3. Requests for Next-Phase Funding

- 1996** A cooperative effort between the Service and CDFG to conduct winter chinook salmon spawning ground surveys was developed in 1996. This "expanded" effort was funded through the Service, AFRP and CVPIA. The 1996 expanded surveys included two crews (two boats and two people per boat) surveying from Keswick Dam (RM 301) downstream to the mouth of Battle Creek (RM 272) from May through August. This area was divided into 4 different sections and each section was surveyed only once per week. In addition to looking for hatchery-origin winter chinook salmon and collecting tissue samples for genetic analysis, a carcasses mark-and-recapture technique was used to estimate escapement. Approximately 130 carcasses were collected and, again, no hatchery origin winter chinook salmon were observed. The escapement estimate using carcass mark-and-recapture was 820 compared to the 940 estimated using RBDD counts.
- 1997** Effort was again expanded (i.e. co-staffed and funded by the Service and CDFG) in an attempt to tag and recover more carcasses and also concentrated to locations near Redding, Keswick Dam downstream to Clear Creek Riffle (RM 288). Approximately 240 carcasses were collected. Four hatchery-origin winter chinook were encountered. The escapement estimate using carcass mark-and-recapture was 2,053 compared to 841 using RBDD counts.
- 1998** A continued cooperative effort (Service and CDFG) surveyed from Keswick Dam downstream to the Clear Creek Riffle. Approximately 785 carcasses were collected, and four hatchery-origin winter chinook salmon were collected. The escapement estimate using carcass mark-and-recapture was 5,501 compared to 2,612 using RBDD counts.
- 1999** A continued cooperative effort (Service and CDFG) surveyed from Keswick Dam downstream to the Clear Creek Riffle. Approximately 475 carcasses were collected including 5 hatchery-origin winter chinook salmon. The escapement estimate using carcass mark-and-recapture was 1,821 compared to 3,208 using RBDD counts.
- 2000** Surveys in progress (Initiated on 3 May 2000).



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Northern Central Valley Fish and Wildlife Office
10950 Tyler Road
Red Bluff, California 96080
Office (530) 527-3043 Fax (530) 529-0292

May 15, 2000

Mr: Michael Warren
Redding City Manager
777 Cypress Ave.
Redding, California 960001

Dear Mr. Warren

The U.S. Fish and Wildlife Service is pleased to provide you with copies of four salmon and steelhead monitoring, assessment, and research project **proposals** we are submitting to the CALFED Bay-Delta Program for funding consideration in response to the 2001 Proposal Solicitation Package. The projects that are proposed to be conducted in or near the City of Redding;

1. Sacramento River winter chinook salmon carcass survey,
2. Battle Creek anadromous salmonid monitoring projects,
3. Clear Creek juvenile salmonid monitoring project,
4. Estimating the abundance of Sacramento River juvenile winter chinook salmon with comparisons to adult escapement.

Prior to conducting any monitoring efforts on private lands, written permission from landowners will be obtained. We have already taken steps to contact local landowners, discuss with them our proposed activities, and ask for permission to conduct these studies on their lands.

The information generated **from** these monitoring efforts are expected to improve our understanding of the ecological and physical processes affecting the salmon and steelhead resources of the north state. Through projects such **as** these, we hope to reduce the scientific uncertainties and recover listed stocks of salmon and steelhead.

Should you require further information, please contact me at (530) 527-3043.

Sincerely,

James G. Smith
Project Leader

Enclosures



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Northern Central Valley Fish and Wildlife Office
10950 Tyler Road
Red Bluff, California 96080
Office (530) 527-3043 Fax (530) 529-0292

May 15, 2000

Mr. Ron Hill
Director, Public Works
1855 Placer Street
Redding, California 96001

Dear *Mr.* Hill

The U.S. Fish and Wildlife Service is pleased to provide **you** with copies of four salmon and steelhead monitoring, assessment, and research project proposals we are submitting to the CALFED Bay-Delta Program for funding consideration in response to the **2001** Proposal Solicitation Package. The projects that are proposed to be conducted in or near Shasta and Tehama counties are,

- 1 Battle Creek anadromous salmonid monitoring projects,
2. Clear Creek juvenile salmonid monitoring project,
3. Sacramento River winter chinook salmon carcass survey,
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Northern Central Valley Fish and Wildlife Office
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Red Bluff, California 96080
Office (530) 527-3043 Fax (530) 529-0292

May 15, 2000

Mr. Irwin Fust
Chair, Shasta County Board of Supervisors
1815 Yuba Street, Suite 1
Redding, California 96001

Dear Mr. Fust:

The **U.S.** Fish and Wildlife Service is pleased to provide you with copies of four salmon and steelhead monitoring, assessment, and research project proposals we are submitting to the CALFED Bay-Delta **Program** for funding consideration in response to the 2001 Proposal Solicitation Package. The projects that are proposed to be conducted in **or** near Shasta and Tehama counties are,

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FISH AND WILDLIFE SERVICE

Northern Central Valley Fish and Wildlife Office
10950 Tyler Road
Red Bluff, California 96080
Office (530) 527-3043 Fax (530) 529-0292

May 15, 2000

Mr. George Russell
Chair, Tehama County Board of Supervisors
PO Box 250
Red Bluff, California 96080

Dear Mr. Russell

The U.S. Fish and Wildlife Service is pleased to provide you with copies of four salmon and steelhead monitoring, assessment, and research project proposals we are submitting to the CALFED Bay-Delta Program for funding consideration in response to the 2001 Proposal Solicitation Package. The projects that are proposed to be conducted in or near Tehama and Shasta counties are,

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James G. Smith
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